

IES Newsletter

Volume 16, Number 2
March - April 1999

Director's Note

Usually in this space I introduce the topics featured in the current *IES Newsletter*. Following that format, for this issue I would have written a brief background on the research described on page one, aimed at learning what factors affect forest growth, and maybe on the article about acid precipitation as well.

But, a particularly sad event takes precedence. In February, I lost my Administrative Assistant of 16 years. When I came to the Institute in September 1983, Janice Claiborne already had almost 10 years of experience working for directors of the Mary Flagler Cary Arboretum. She was a big help to me as I learned my new job, and her intelligence and efficiency were invaluable as the Institute grew in size and scope.

I, along with everyone at the Institute and those of you who knew Janice through the IES membership program, will miss her.

The *IES Newsletter* is published by the Institute of Ecosystem Studies, located at the Mary Flagler Cary Arboretum in Millbrook, New York.

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Investigating the Forces of Forest Change

The Mary Flagler Cary Arboretum covers almost 2,000 acres. Those of you who have walked its trails or driven its perimeter and internal roadways might try to imagine hiking across those acres, back and forth, field equipment in your backpack, on a hunt for young trees. If you now imagine the same hike on a parcel of land four times the Arboretum's size, you'll be in the shoes of Seth Bigelow as he did the groundwork for a study to address one of ecology's mysteries: what factors contribute to determining the composition of a natural community?

The community that Dr. Bigelow is interested in is the forest. Previous research by IES ecologist Dr. Charles Canham and colleagues has shown that in adult trees there is a strong relationship between the individual tree species and the amount of calcium in the soil. Oak trees and hemlocks thrive in soils with low levels of calcium, while maples — especially sugar maples — and ash thrive in soils with high calcium content. Why is this? In spite of the long life span and immobility of trees, forests change, and with a long-term view toward both forest health and the demand for certain economically important species, we humans are in a stronger position if we know what factors control their growth and survival.

A team of ecologists is working at the 8000 acre Great Mountain Forest in northwestern Connecticut to learn more about the relationship between soil calcium and trees. Some team members — Drs. Gene Likens and Gary Lovett from IES, Dr. Nico van Breemen and doctoral student Feike Deikstra from Wageningen Agricultural University in The Netherlands, and Dr. Adrien Finzi from Duke University — are investigating the roles that trees play in the relationship: do the deeper roots of some species, for example, bring to the surface nutrients that change the composition of the soil? At the same time, Drs. Bigelow and Canham are approaching

the question from the environmental side: how do soil properties and light affect tree growth?

Dr. Bigelow, an IES postdoctoral associate, arrived at the Institute in May 1998 and started his study by searching the Great Mountain Forest for ash, red maple, sugar maple, beech, red oak and hemlock saplings. At five spots around the trunk of each of the 1100 saplings he selected, he and IES research assistant Connie Chase took light readings, measured annual growth by looking at leaf scars, and collected soil samples. Now, beginning in early April of this year, he is testing specific nutrients to see how they affect those same saplings.

In a process that Dr. Bigelow said will take two people two to three weeks to complete, each sapling is being fertilized with one of five elements — calcium, magnesium, nitrogen, potassium or a carbonate material that changes soil pH, each in combination with sulfate to promote dissolution. Half of the control group of trees is being treated with sodium sulfate to see if the sulfate itself has any effects, and the other half is untreated. In autumn 2000, just after a second post-fertilization growing season, the scientists will return to measure growth. Growth response will be an indication of the importance of the fertilizing agent.

continued on page 3



Dr. Bigelow measures the branches of saplings to compare the effects of different soil nutrients on tree growth.

KEN BIZZIGOTTI

Is Buying and Selling Pollution the Solution?

An Acid Precipitation Primer

It could be argued that "acid rain" had its beginnings millions of years ago, when the Earth's geological and physical environments were catalysts that turned decomposing plant and animal remains into petroleum, coal and natural gas. These end-products, the "fossil fuels" for humans today, therefore contain the chemicals that constitute life, whether prehistoric or modern. Among the chemicals are sulfur and nitrogen.

Today, as fossil fuels are burned, in industry, automobiles, power plants and homes, the stored sulfur is released to the atmosphere as sulfur dioxide and the nitrogen as nitrogen oxides. When these chemicals react in the clouds of the atmosphere, dilute sulfuric and nitric acids are produced and are delivered to the Earth in rain, snow, cloud, fog and even as dry particles and gases.

In 1970 the U.S. Government passed the Clean Air Act, the purpose of which was to control pollution at its source by setting national air quality standards and requiring states to reduce emissions of particulates, sulfur dioxide and nitrogen oxides. Evidence of the harmful effects of acid deposition grew, however, and some twenty years later, presented with irrefutable evidence supported by the discoveries of scientists including IES Director Dr. Gene Likens and his Hubbard Brook Ecosystem Study colleagues, Congress passed the Clean Air Act Amendments of 1990. This legislation added to and strengthened the regulatory requirements of the earlier Clean Air Act, and for the first time focused on acid rain.

Limitations of the Free Market

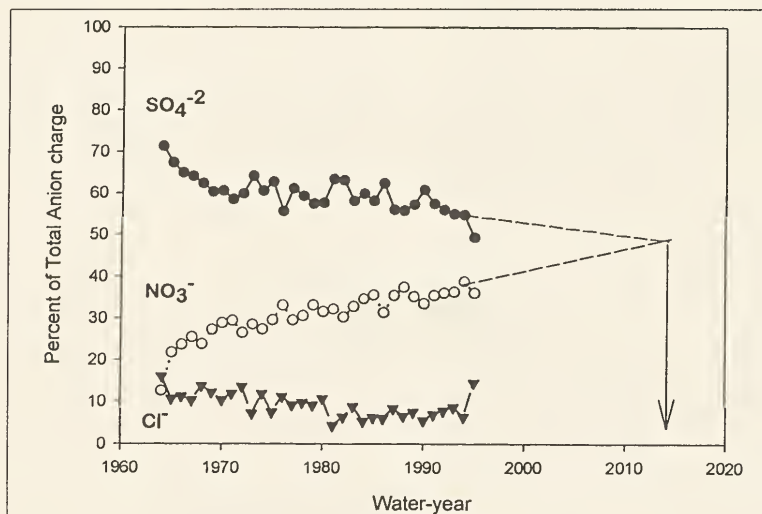
One of the features of the 1990 amendments was establishment of an "emissions trading system". An annual, nationwide limit on emissions was set, and each power plant was given an emissions allowance for sulfur, calculated as a percentage of its 1980 emissions. Plants were restricted from emitting more of this pollutant than they had allowances for, unless they bought the necessary number of allowances from a plant that hadn't used all of its own. This was the first time that a free-market approach to an environmental challenge of this sort had been tried.

In a letter published in the 11 December 1998 issue of *Science*, Dr. Likens, Dr. Kathleen Weathers¹, Mr. Thomas Butler and Mr. Donald Buso wrote, "We applaud the successful application of flexible

regulatory mechanisms in combination with a free-market approach in lowering the costs of reducing sulfur emissions to the atmosphere." The four IES ecologists, however, all of whom are involved in ongoing studies of acid deposition, cloudwater and dry deposition, also explained their misgivings. "A trading program that cuts U.S. emissions, but allows continued amounts of damaging deposition on sensitive ecosystems would miss the point." They went on to question whether the 1990 Clean Air Act Amendments will adequately reduce the atmospheric deposition of sulfur and nitrogen compounds to sensitive ecosystems, such as the Appalachian and Adirondack Mountain regions and eastern Canada, and whether these sensitive ecosystems can recover from the current and projected impact of acid rain.

They back up their concerns with evidence, including citations of published papers that suggest the expected recovery of natural ecosystems from acid rain damage has not been observed. They also explain that recent studies at the Hubbard Brook Ecosystem Forest in New Hampshire show that about 45% of acidity in precipitation is contributed by nitric acid, and that if present trends continue it will become the dominant acid in precipitation early in the next century. Yet the focus

1. Dr. Weathers' study of cloudwater chemistry in Chile was featured in the January-February 1999 issue of the IES Newsletter.



Percent of total anion charge in bulk precipitation at the Hubbard Brook Experimental Forest from 1963-64 to 1995-96 (from "The importance of long-term data in addressing regional environmental issues", by Gene E. Likens and Kathleen Fallon Lambert, published in *Northeastern Naturalist*, Volume 5 Number 2, 1998. This graph shows the steady increase in the proportion of nitrate, a precursor of nitric acid, over the past 30 years.

of federal legislation has been almost exclusively on controlling sulfur emissions; there is currently no cap on the total emission of nitrogen oxides. Finally, the IES researchers note that dry deposition of acidifying gases and particles, which can contribute 30% to 50% of total acid deposition, also has significant impact on ecosystems.

The IES scientists conclude with a critical argument for the reduction of acid-forming emissions rather than the trading of rights to emit. "... acidifying gases and particles of sulfur contribute to the acid rain problem when they are deposited to the Earth's surface, after being transported in the atmosphere," they write. If the emissions continue at anything close to their present levels, sensitive ecosystems downwind of sources of pollution will continue to be severely altered, and the location of the emissions source, contributing deposition of acids to the receiving ecosystem, matters.

Reminder:

IES Spring Plant Sale

Friday, May 21: 10 a.m. - 4 p.m.

Saturday, May 22: 10 a.m. - 4 p.m.

Sunday, May 23: 11 a.m. - 4 p.m.

For information, call:
914/677-5365

Forest Change, from page 1

Data from Dr. Bigelow's research, along with the findings of his collaborators, will be plugged into an existing computer model designed by Dr. Canham and co-workers that predicts species composition and tree location over a long periods. By using tree species and soil calcium data gathered from other forests in addition to the one they are studying, the scientists will be able to predict what different forest sites will look like 1000 years from now. Will the sugar maples in the year 3000 be in the same place as they are now? Or will they have been replaced by hemlocks? And what about the economically important oaks? The scientists hope that their new knowledge of the role of human impacts, through alteration of nutrient inputs, and of the role played by the trees themselves, will help them to address questions of long-term forest change. ●

Dr. Seth Bigelow received his masters and doctoral degrees from the University of Florida. His doctoral research, done in Costa Rica's tropical rainforests, investigated the loss of soil nutrients after forest clearing. By comparing short rotation cropping systems with longer rotations and measuring which allowed more nutrients to drain through the system, he discovered that under short rotation there was an increase in nitrogen loss from soil and a resulting decrease in soil fertility. In March, he returned to Costa Rica for three weeks to do a related study on evapotranspiration, or water vapor loss from leaves. Dr. Bigelow will be at IES through fall 2000.

Director's Program for Visiting Scientists



Dr. Doris Soto (above), Full Professor in Aquatic Ecology at the Universidad Austral de Chile, spent 10 days at the Institute in February under the auspices

In Memoriam: Janice B. Claiborne

A query about your IES membership? Call Janice. Need to set up a meeting with the director? Call Janice. A question about IES scientific publications? Call Janice. Need a listing of IES graduate students? Call Janice. From editorial advice to wry commentary ... from Mary Flagler Cary



Arboretum history to the details of IES administration, these things are what we could count on from Janice Claiborne. The Institute's staff, members and friends were shocked and deeply saddened when Ms. Claiborne died suddenly on February 18, 1999.

In autumn 1974 Janice Byrns Claiborne, intrigued by the newly opened Mary Flagler Cary Arboretum, applied for a secretarial position and was hired. She worked for a number of the Arboretum staff, including botanist Dr. Thomas Elias, plant geneticist Dr. David Karnosky and executive administrator Mr. George Bookman before becoming the assistant to Dr. Willard Payne, Arboretum director from 1977 until 1983. In the meantime, in 1975, the Arboretum instituted a membership program and Ms. Claiborne took on the challenges of membership secretary, building a strong program of which she was proud. When the Institute of Ecosystem Studies opened in fall 1983, Ms. Claiborne became assistant to its director, Dr. Gene Likens. She remained assistant to the director, as well as membership secretary, until her death.

There was a memorial service at the Institute on March 12, at which IES staff recalled Ms. Claiborne's contributions to their lives as well as to their work. Contributions in memory of Janice Claiborne may be made to the Campaign for the Institute of Ecosystem Studies. ●

Campaign Update

The Campaign for the Institute of Ecosystem Studies was developed to secure the Institute's scientific and educational excellence into the future. The campaign has two goals:

- new environmental research building, to expand IES research capabilities
- endowment of the G. Evelyn Hutchinson Chair, to attract an outstanding senior ecologist

The IES Board of Trustees is pleased to announce that \$5.3 million has been raised to date. To complete the campaign, \$700,000 is needed by October 1999.

of the Director's Program for Visiting Scientists. Dr. Soto's research interests include interactions between zooplankton and fish, global change effects on fresh waters, and the environmental impact of aquaculture, salmon culturing and salmon introduction in fresh and marine waters. In 1990, Dr. Soto and Dr. Likens began collaborative studies of lakes and streams of southern Chile. Over the years she has provided space in her own laboratories as well as general logistical support for IES scientists and graduate students doing research in the Puerto Montt area.

While she was in residence at IES, Dr. Soto shared ideas with staff scientists and discussed future collaborations. At the end of her stay, she presented a talk on the lake ecosystems of Chile, a contribution to the Institute's free public seminar series. ●

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Newsletter

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Calendar

CONTINUING EDUCATION

For spring 1999 program information, call the Continuing Education office at 914-677-9643. Programs during May and June include:

Gardening

May 23: **Natural Landscape Techniques: Design, Planting and Management**
June 6: **Container Gardening**
June 12 & 26: **Fern Identification, Propagation**
June 19: **Healthy, Hardy Roses**
June 20: **Native Wildflowers for the Display Garden**

Landscape Design

June 19: **History of Landscape Design: Great Estates of the Hudson River Valley**

Natural Science Illustration

May 22 - 23: **Sketching Live Animals**
May 24 - 27: **Colored Pencil Illustration**
June 5 (4 sessions): **Botanical Watercolor III: Special Topics - Capturing Summer's Bloom**
Biology and Earth Science

May 11: **Heavenly Bodies**
May 23: **Wild Plant Ident.: Late Spring**
June 5: **Tree Identification**
June 27: **Sedges**

Natural Crafts

June 12: **Oshibana: The Art of Pressing Flowers**

Ecological Excursions

May 15: **Catskill Mountain Ecosystems**
May 15: **Mohonk: The Mountain House, Gardens, Lake and History**
May 16: **Institute of American Indian Studies**
May 22: **Ecology of a Floodplain Forest**
Community: Canoe Exploration of the Great Swamp
June 5: **Canoe & Cobble: A Special Trip to Bartholomew's Cobble**
June 5: **Catnip Acres Herb Gardens & Gertrude Jekyll's Glebe House Garden**
June 19: **Great Estates (see Landscape Design programs, above)**

GREENHOUSE

The IES greenhouse, a year-round tropical plant paradise and a site for controlled environmental research, is open until 3:30 p.m. daily except public holidays. Admission is by free permit (see HOURS).

ART EXHIBIT

Illustrations by Linda Beckwith McCloskey are on display in the Plant Science Building lobby. Four of the seven drawings in the exhibit are original plates from the *Hudson River Field Guide to Plants of Freshwater Tidal Wetlands*, published by the NYS Department of Environmental Conservation. Previous work by Ms. Beckwith McCloskey, a student and instructor in the IES Natural Science Illustration Program, has been published in IES Continuing Education Program catalogues, *Earthworks*, and the 1996-1997 IES report. This exhibit is open weekdays from 9-4. Admission is free with a visitor permit.

IES SEMINARS

Free scientific seminars are held each Friday at 11:00 a.m. at the IES Auditorium.
May 7: **There's More to Exotic Plant Invasions Than Meets the Eye: The Belowground Connection.** Dr. Joan Ehrenfeld, Cook College, Rutgers Univ.
May 14: **Biogeochemistry of Phosphorus in the Australian Lowland Rivers.** Dr. Barry Hart, Water Studies Centre, Monash Univ., Australia

• *The Friday Seminar Series resumes in September.* •

IES ECOLOGY SHOP

New in the Shop ... flower-of-the-month magnets ... floral pins ... bird-of-paradise (from the IES Greenhouse) notecards ... IES T-shirts and sweatshirts ... **for children ...** butterfly and frog books for the very young ... metamorphosing animal toys ... **and in the Plant Room ...** terra cotta planters ... brass planters ... new supplies of EZ diggers and Ecospouts
Senior Citizens Days: 10% off on Wednesdays
• *Gift Certificates are available.* •

VOLUNTEER OPPORTUNITIES

Current Needs

Education Program Office: weekday telephone reception
IES Ecology Shop: weekday and weekend visitor orientation and/or customer assistance
Volunteer Program: help with administration, 3-5 hours a week.
For information, call Ms. Su Marcy at 914-677-7641.

HOURS

Summer hours: April 1 - September 30
Public attractions are open Mon. - Sat., 9 a.m.-6 p.m. & Sun. 1-6 p.m., with a free permit*.
(Note: The Greenhouse closes at 3:30 p.m. daily.)
The **IES Ecology Shop** is open Mon.-Fri., 11 a.m.-5 p.m., Sat. 9 a.m.-5 p.m. & Sun. 1-5 p.m.
(The shop is closed weekdays from 1-1:30 p.m.)
* *Free permits are required for visitors and are available at the IES Ecology Shop or the Education Program office daily until 5 p.m.*

MEMBERSHIP

Join the Institute of Ecosystem Studies. Benefits include subscription to the newsletter, member's rate for courses and excursions, a 10% discount on IES Ecology Shop purchases, and participation in a reciprocal admissions program. Individual membership: \$30; family membership: \$40. Call Laura Corrado in the Membership Office at 677-5343.

The Institute's Aldo Leopold Society
In addition to receiving the benefits listed above, members of The Aldo Leopold Society are invited guests at spring and fall IES science updates. Call Ms. Jan Mittan at 677-5343.

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... **for research, graduate opportunities, library and administration:**

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